

FIG. 1

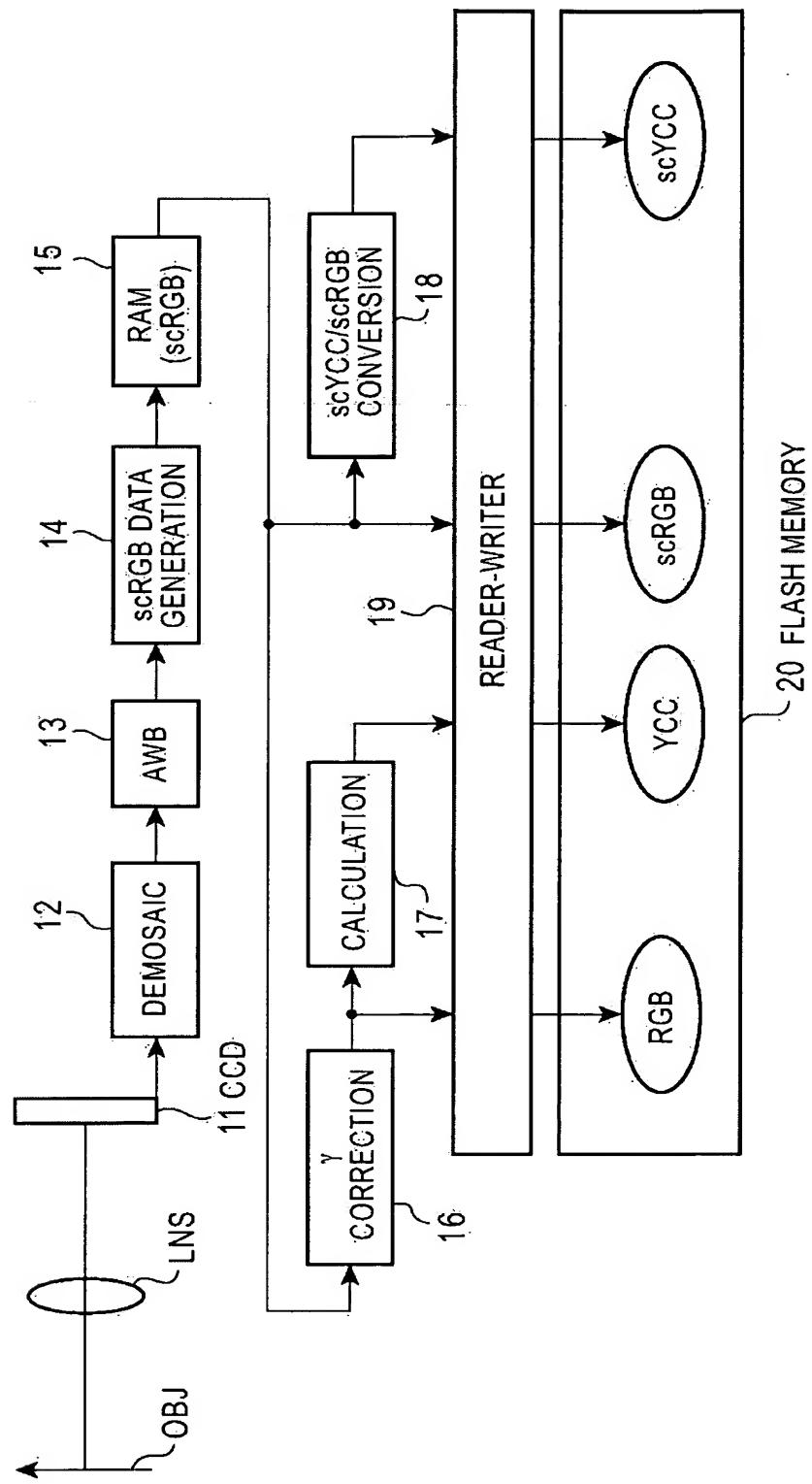
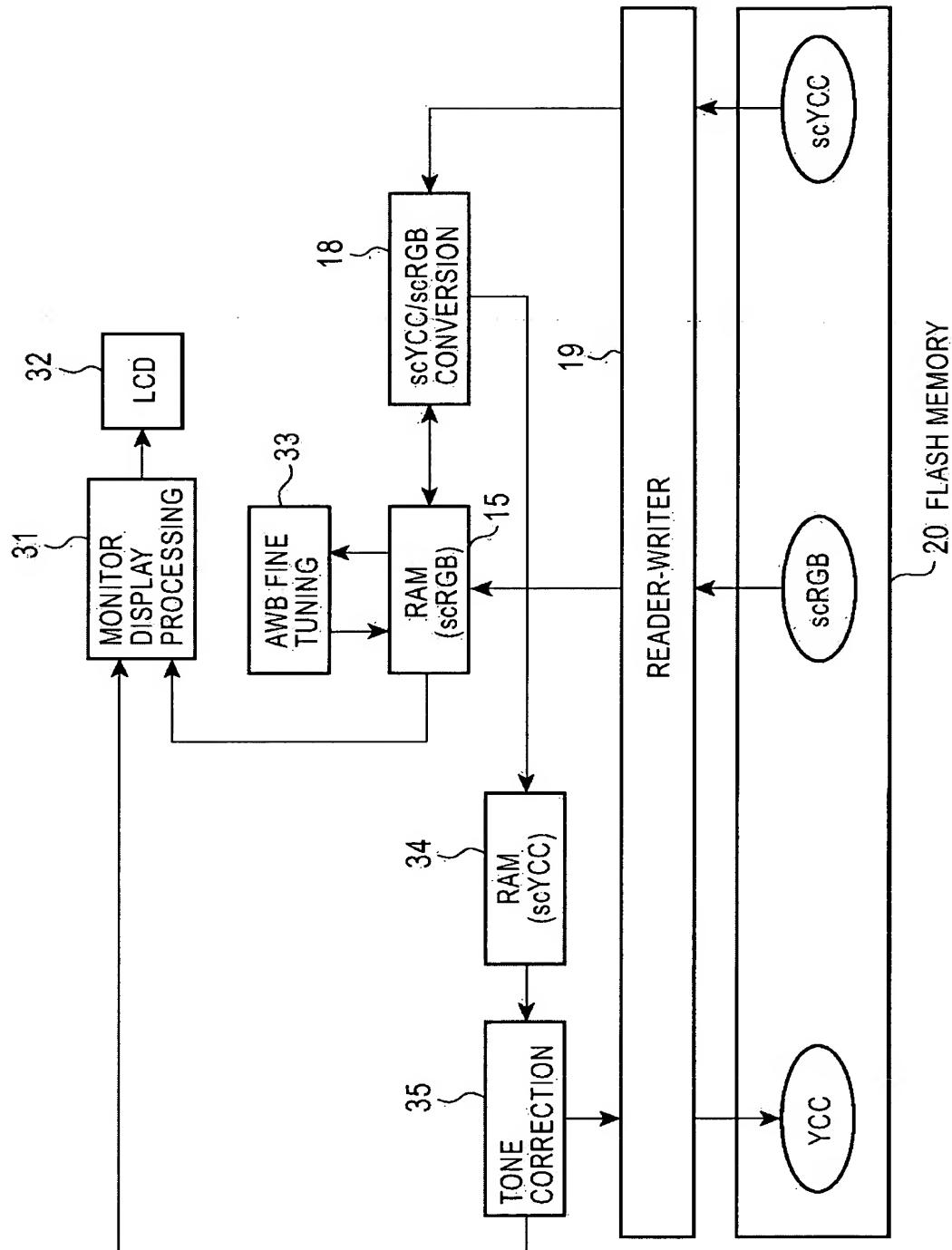


FIG. 2



3/25

FIG. 3

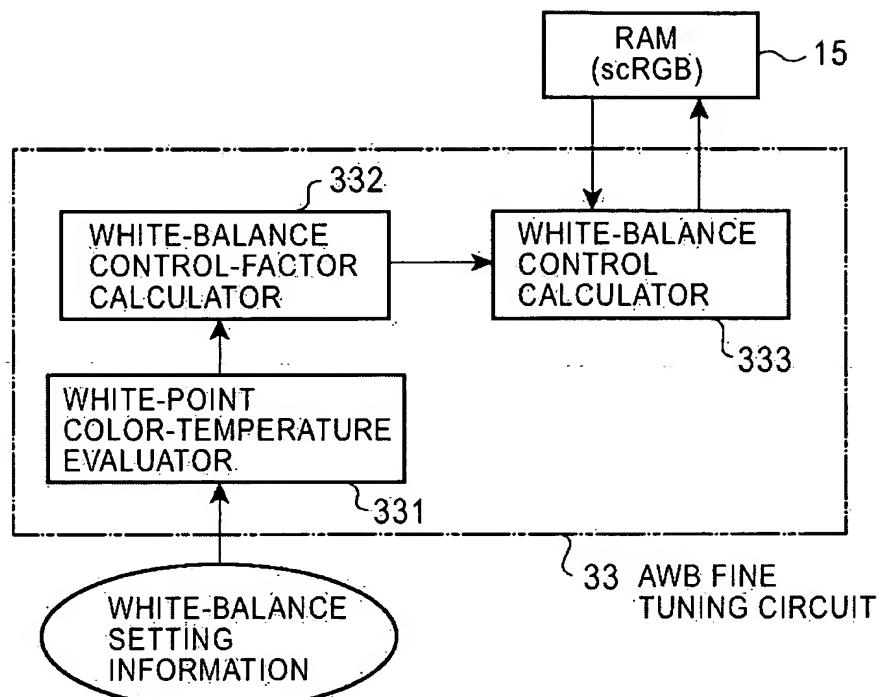
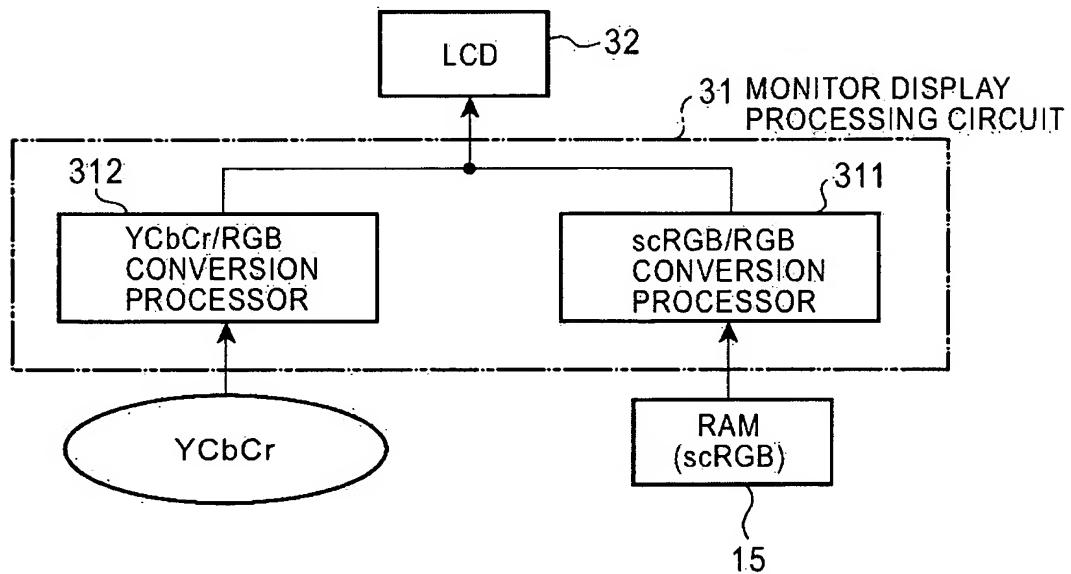
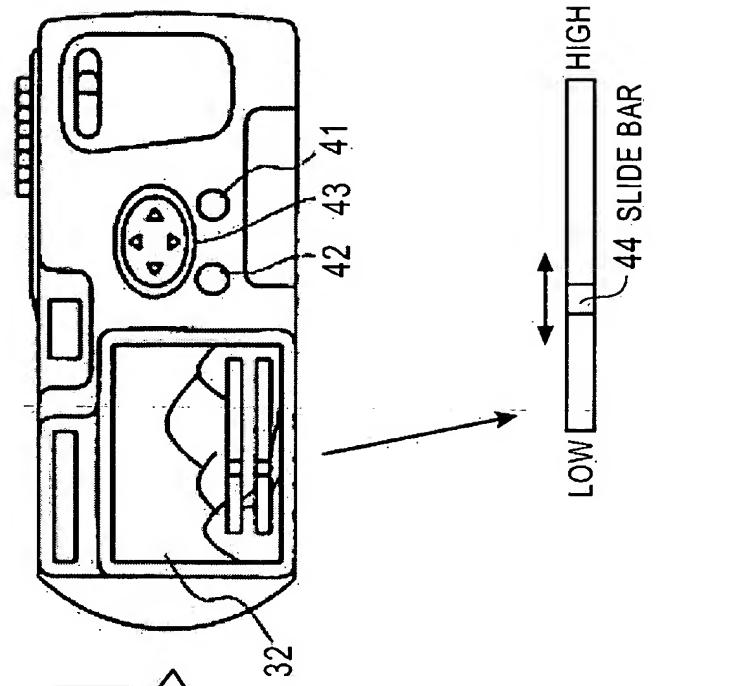
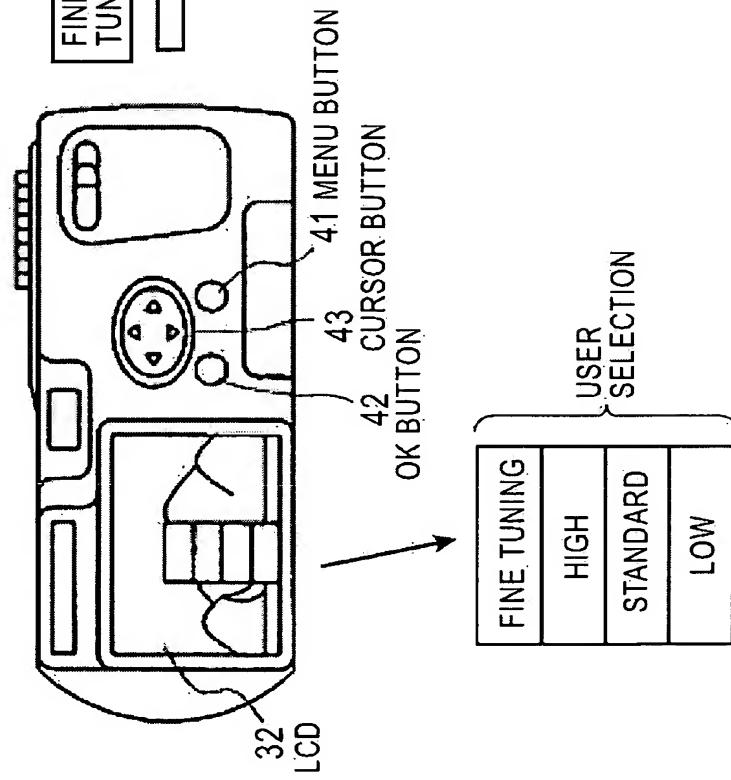


FIG. 4



4/25

FIG. 5A



5/25

FIG. 6A

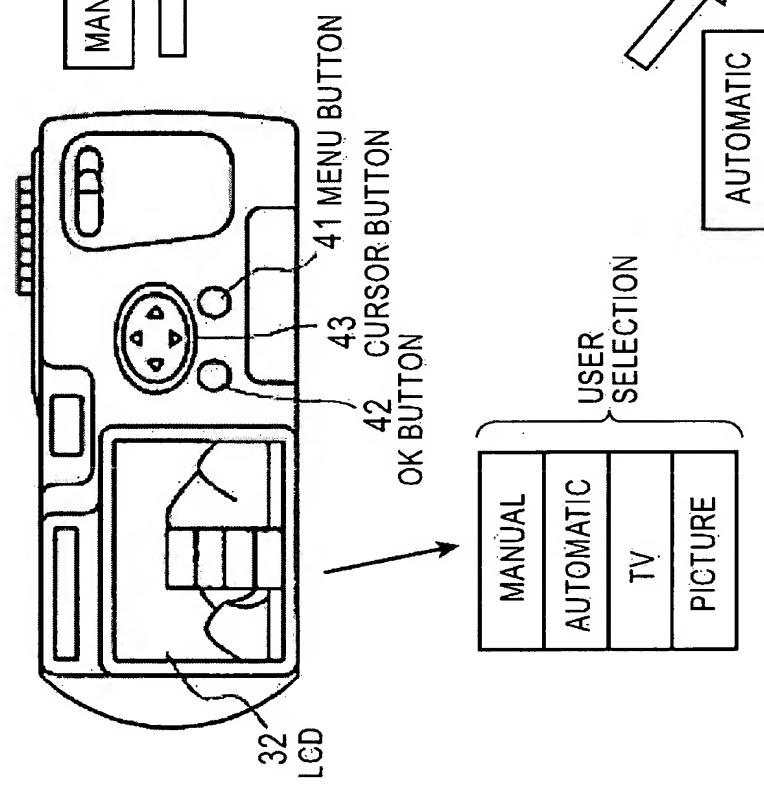


FIG. 6B

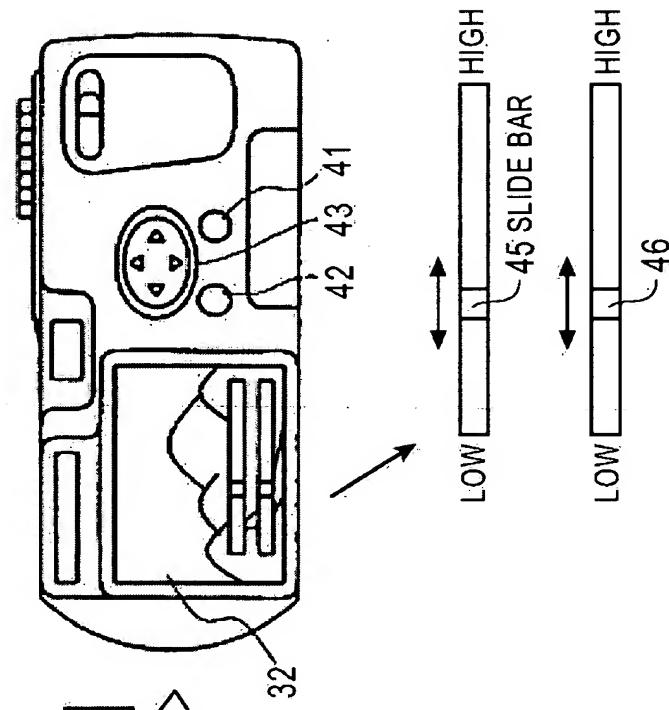


FIG. 6C

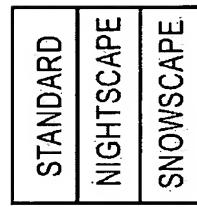
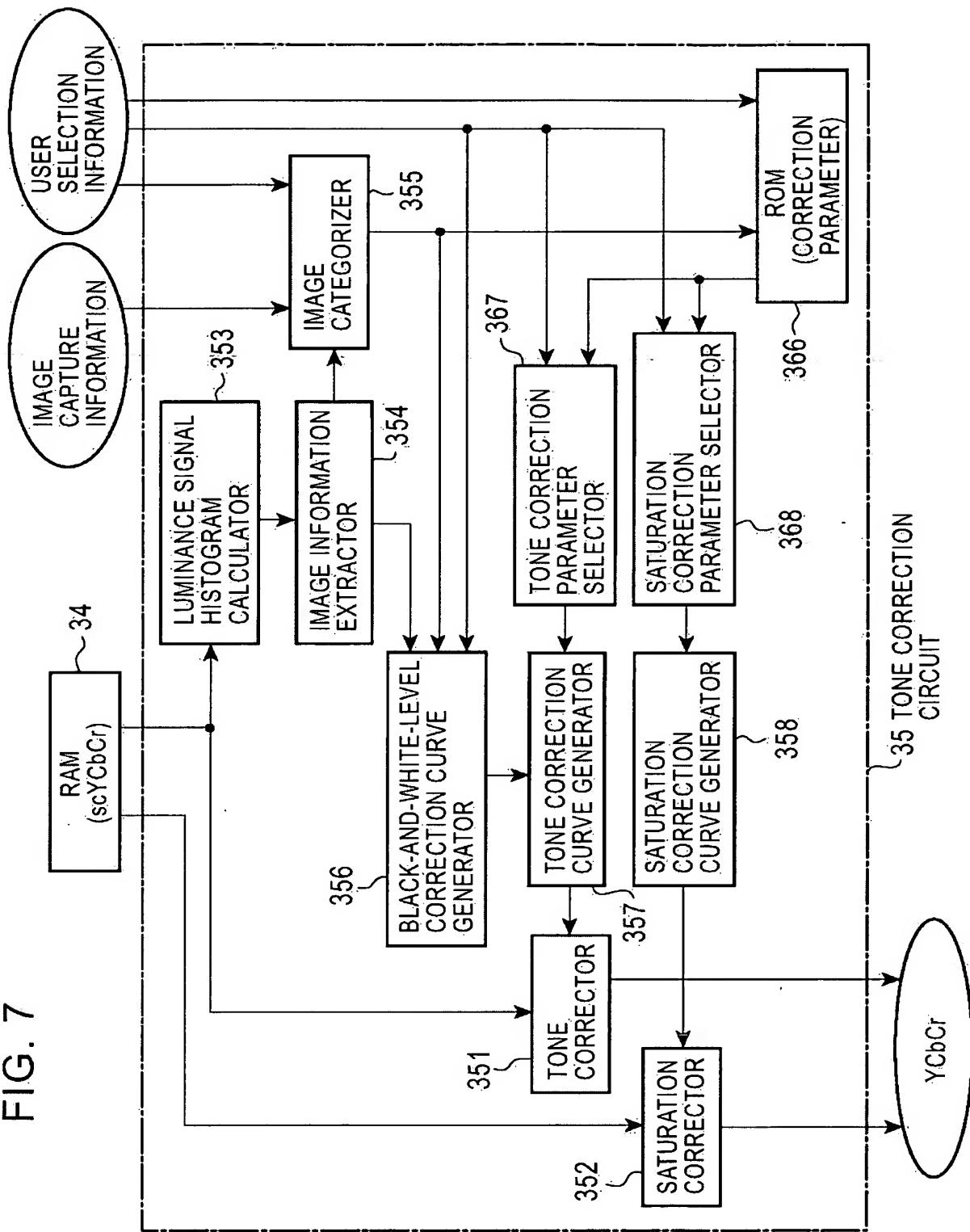


FIG. 7

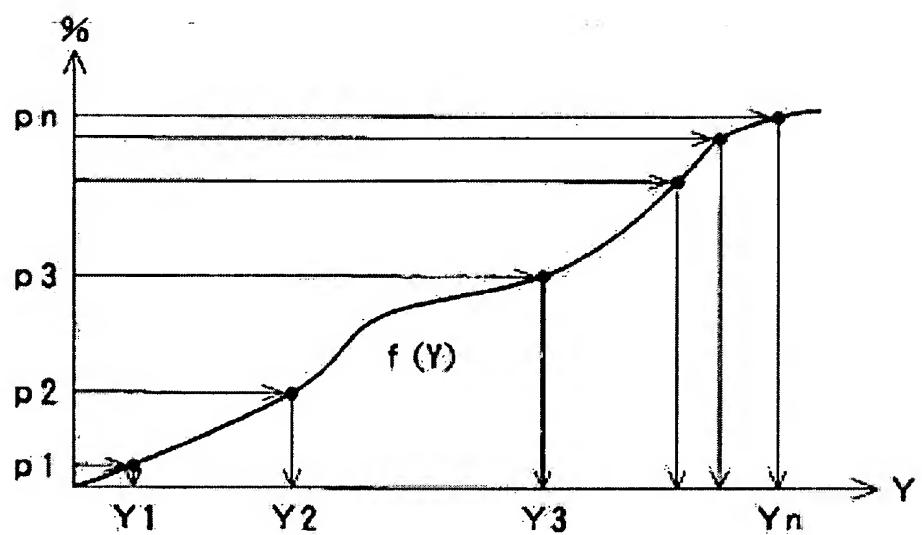


10/527137

S03P1083

7/25

FIG. 8

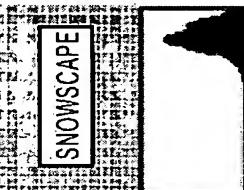
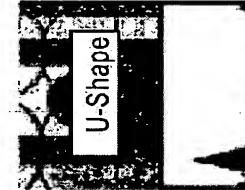
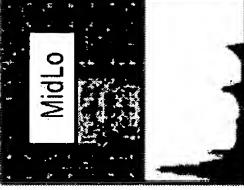
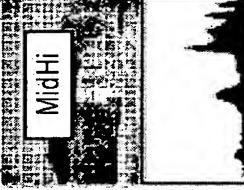
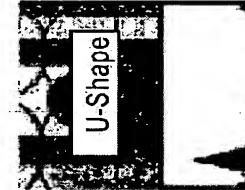
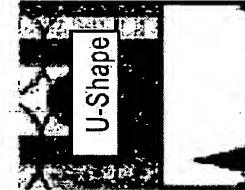
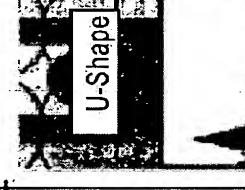


10/527137

S03P1083

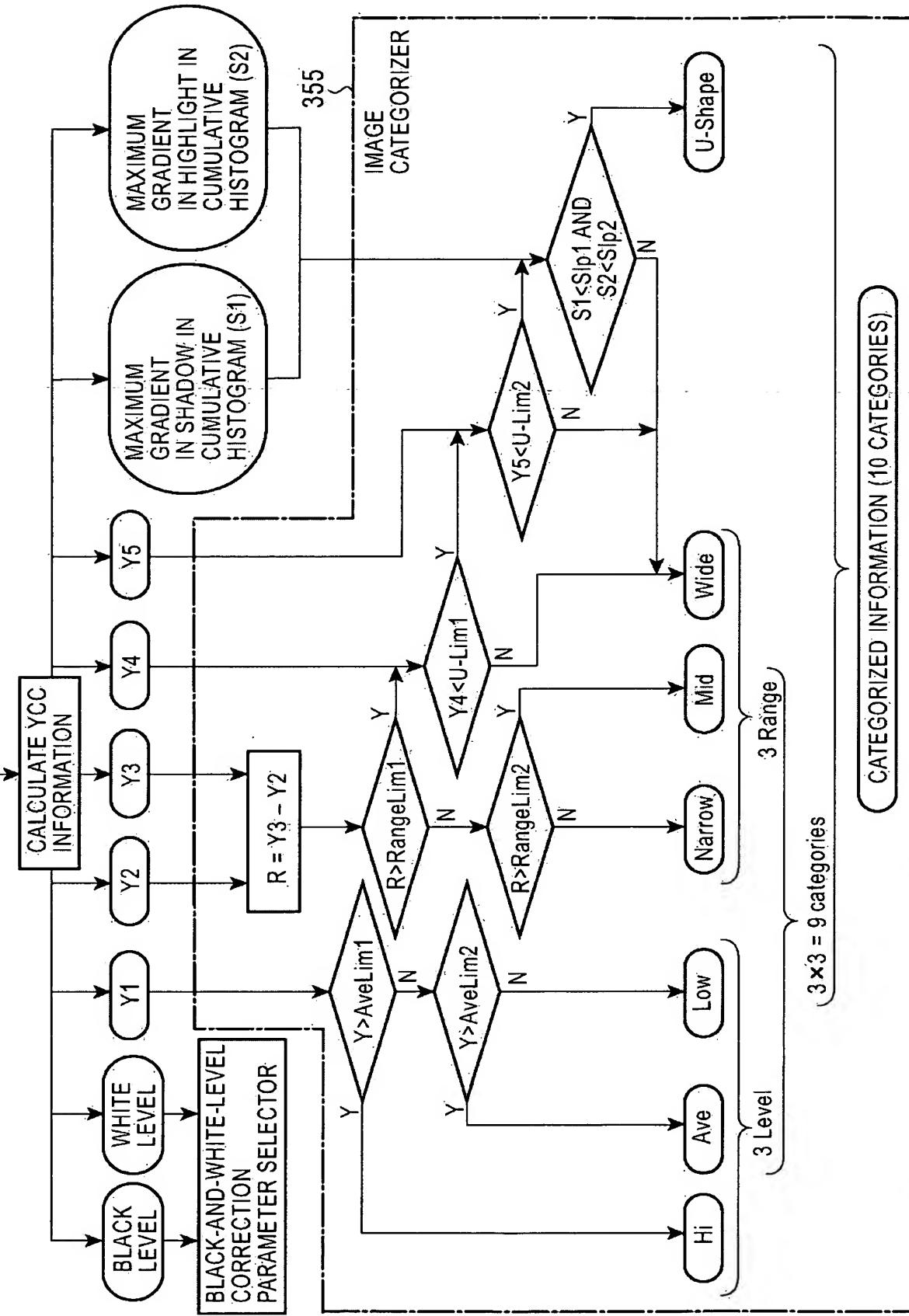
8/25

FIG. 9

IMAGE CATEGORY RESULTING FROM STATISTICAL ANALYSIS OF IMAGE			IMAGE CATEGORY BASED ON INFORMATION ON IMAGE SCENE	
AVERAGE OF LUMINANCE SIGNAL Y				
DARK	AVERAGE	BRIGHT		
NARROW	NarrowLo			
	NarrowAve			
	NarrowHi			
MIDDLE	MidLo			
	MidAve			
	MidHi			
WIDE	WideLo			
	WideHi			
RANGE OF HISTOGRAM OF LUMINANCE SIGNAL Y				

9/25

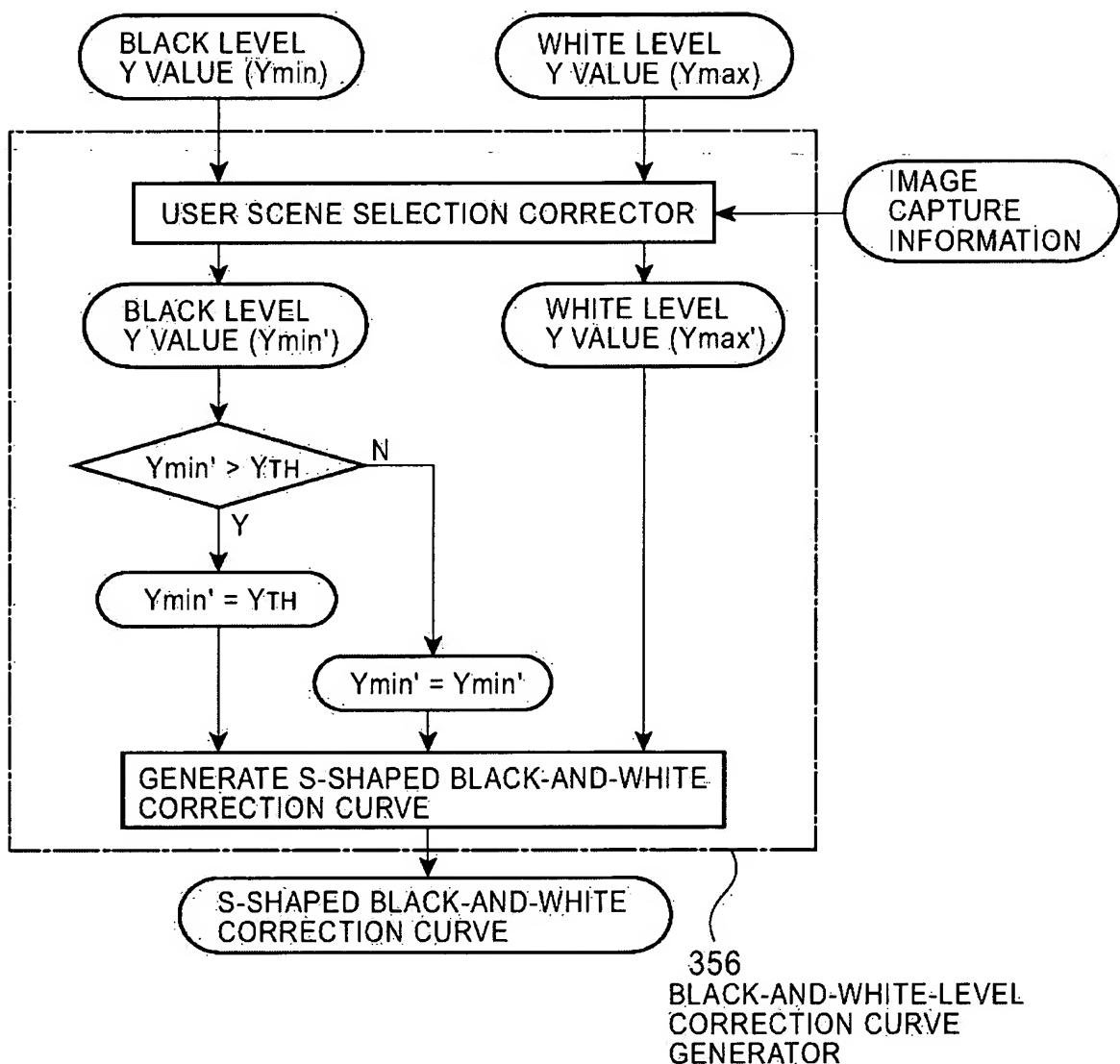
FIG. 10 CUMULATIVE HISTOGRAM OF LUMINANCE SIGNAL



S03P1083

10/25

FIG. 11



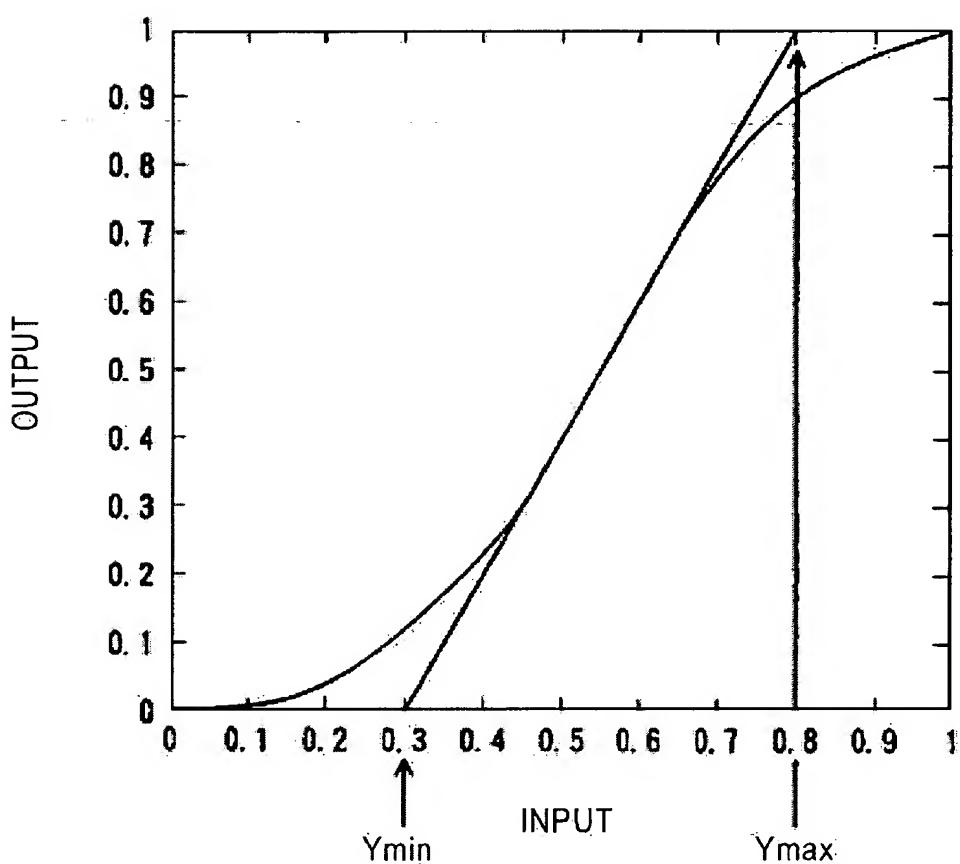
356  
BLACK-AND-WHITE-LEVEL  
CORRECTION CURVE  
GENERATOR

10/527137

S03P1083

11/25

FIG. 12

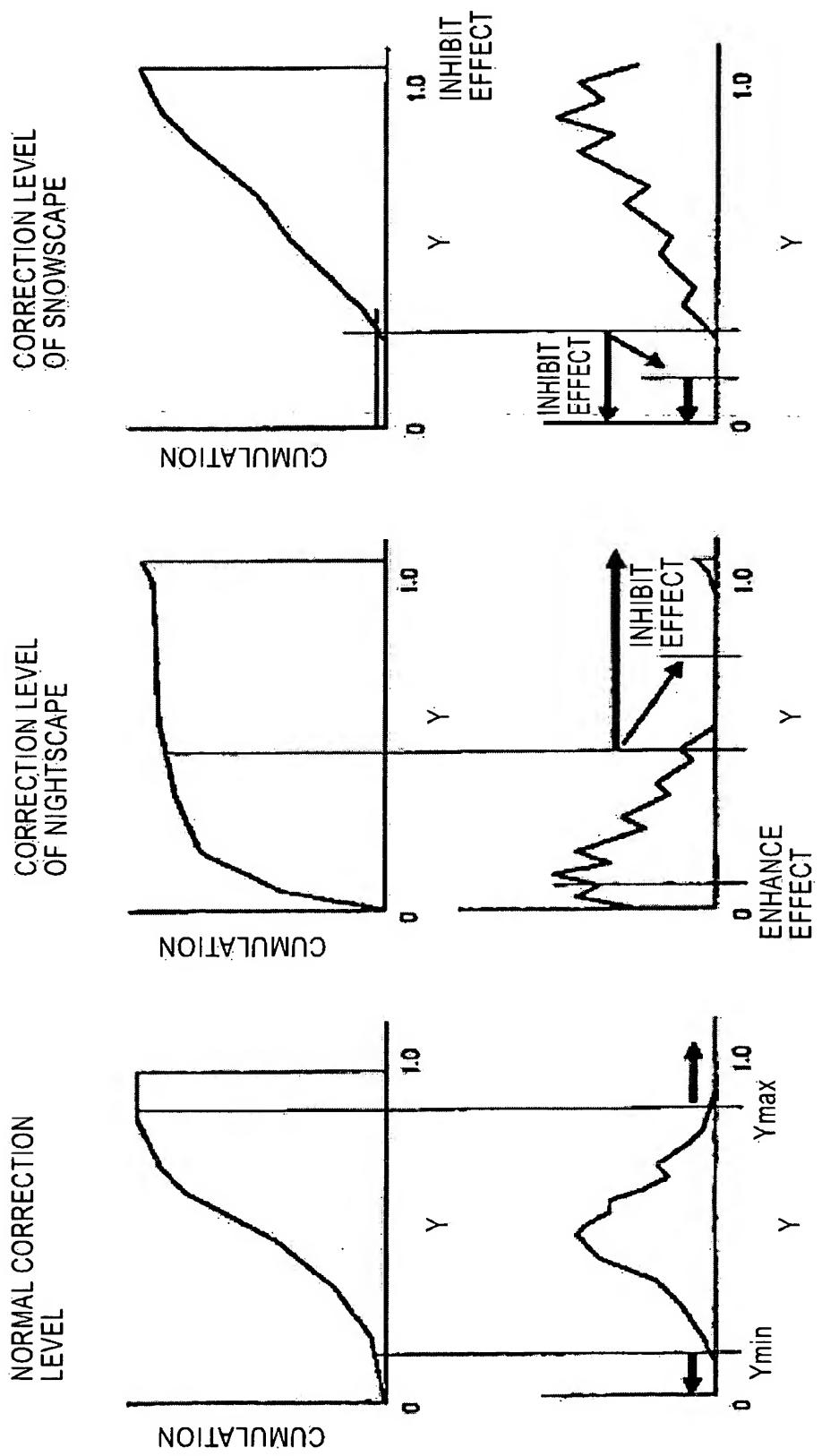


10/527137

S03P1083

12/25

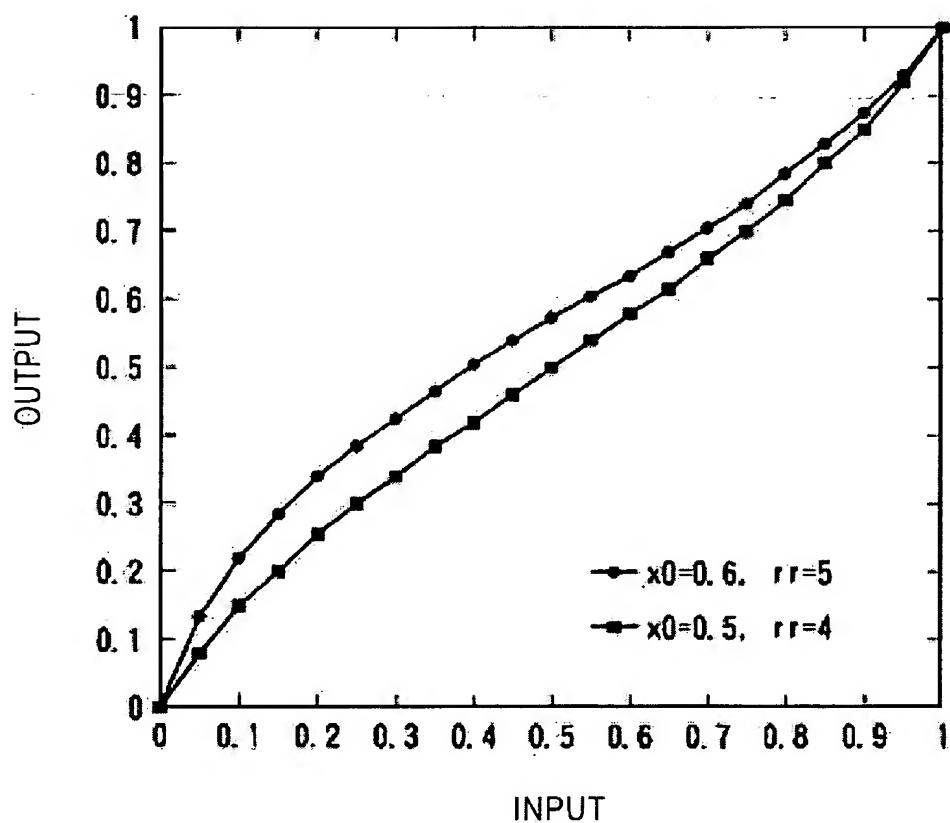
FIG. 13



S03P1083

13/25

FIG. 14



S03P1083

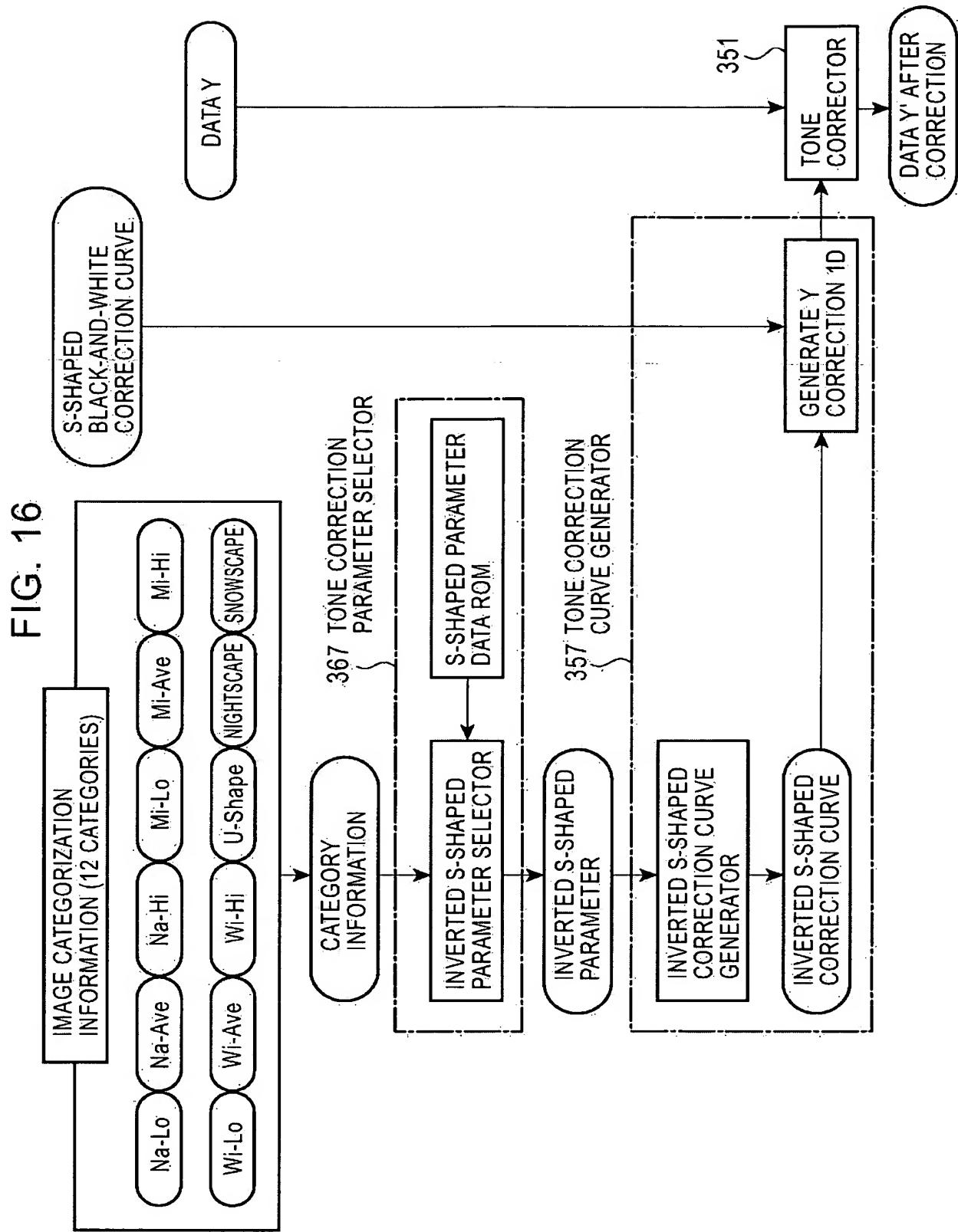
14/25

FIG. 15

	TONE CORRECTION PARAMETER		SATURATION CORRECTION PARAMETER
	x0	r r	k c
Narrow & Low	x0-NL	r r -NL	k c -NL
Narrow & Ave	x0-NA	r r -NA	k c -NA
Narrow & Hi	x0-NH	r r -NH	k c -NH
Mid & Low	x0-ML	r r -ML	k c -ML
Mid & Ave	x0-MA	r r -MA	k c -MA
Mid & Hi	x0-MH	r r -MH	k c -MH
Wide & Low	x0-WL	r r -WL	k c -WL
Wide & Ave	x0-WA	r r -WA	k c -WA
Wide & Hi	x0-WH	r r -WH	k c -WH
U-Shape	x0-U	r r -U	k c -U
NIGHTSCAPE	x0-N	r r -N	k c -N
SNOWSCAPE	x0-S	r r -S	k c -S

S03P1083

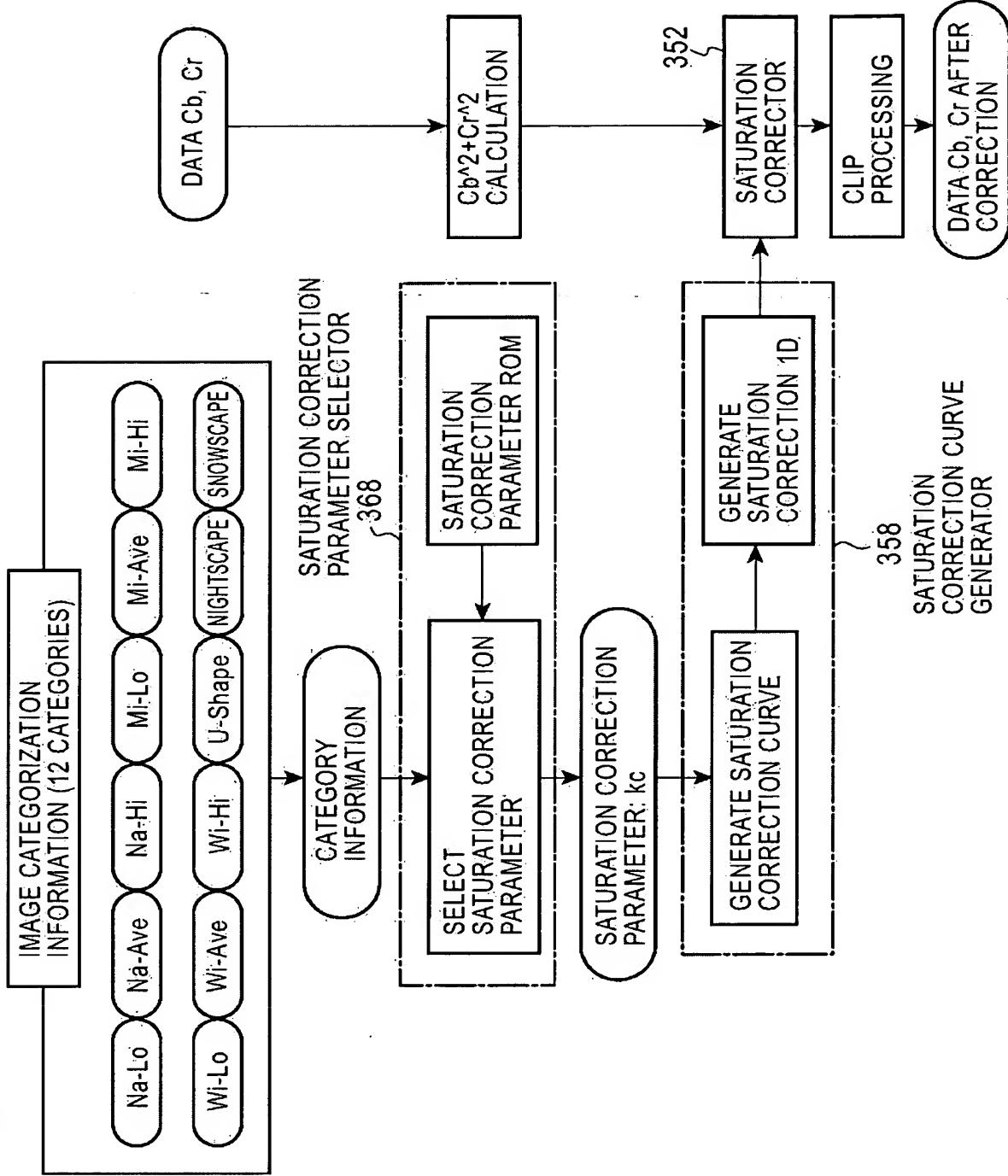
15/25



S03P1083

16/25

FIG. 17



10/527137

S03P1083

17/25

FIG. 18

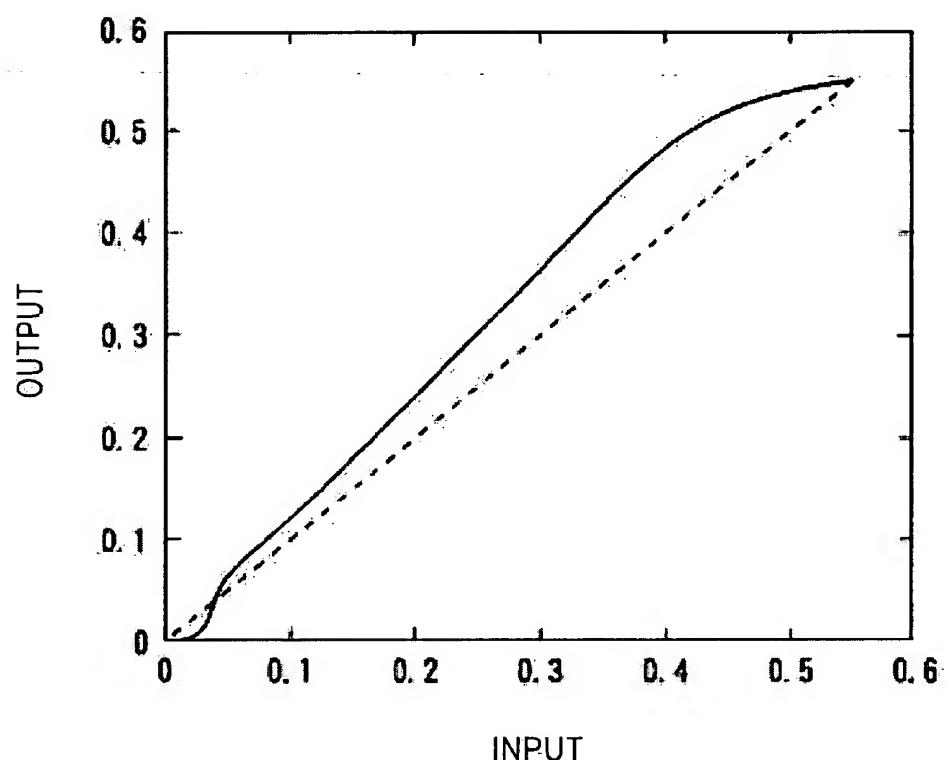
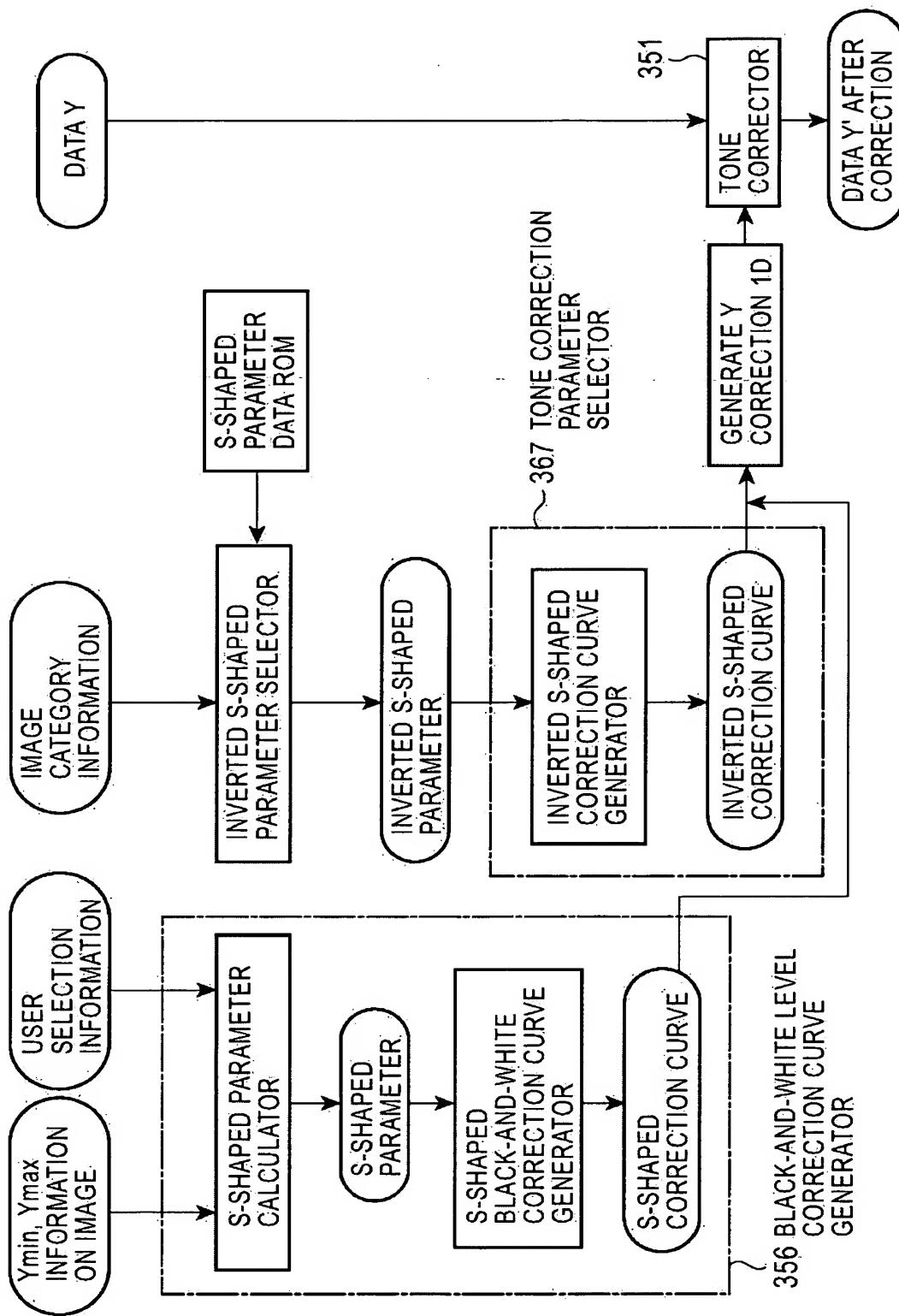
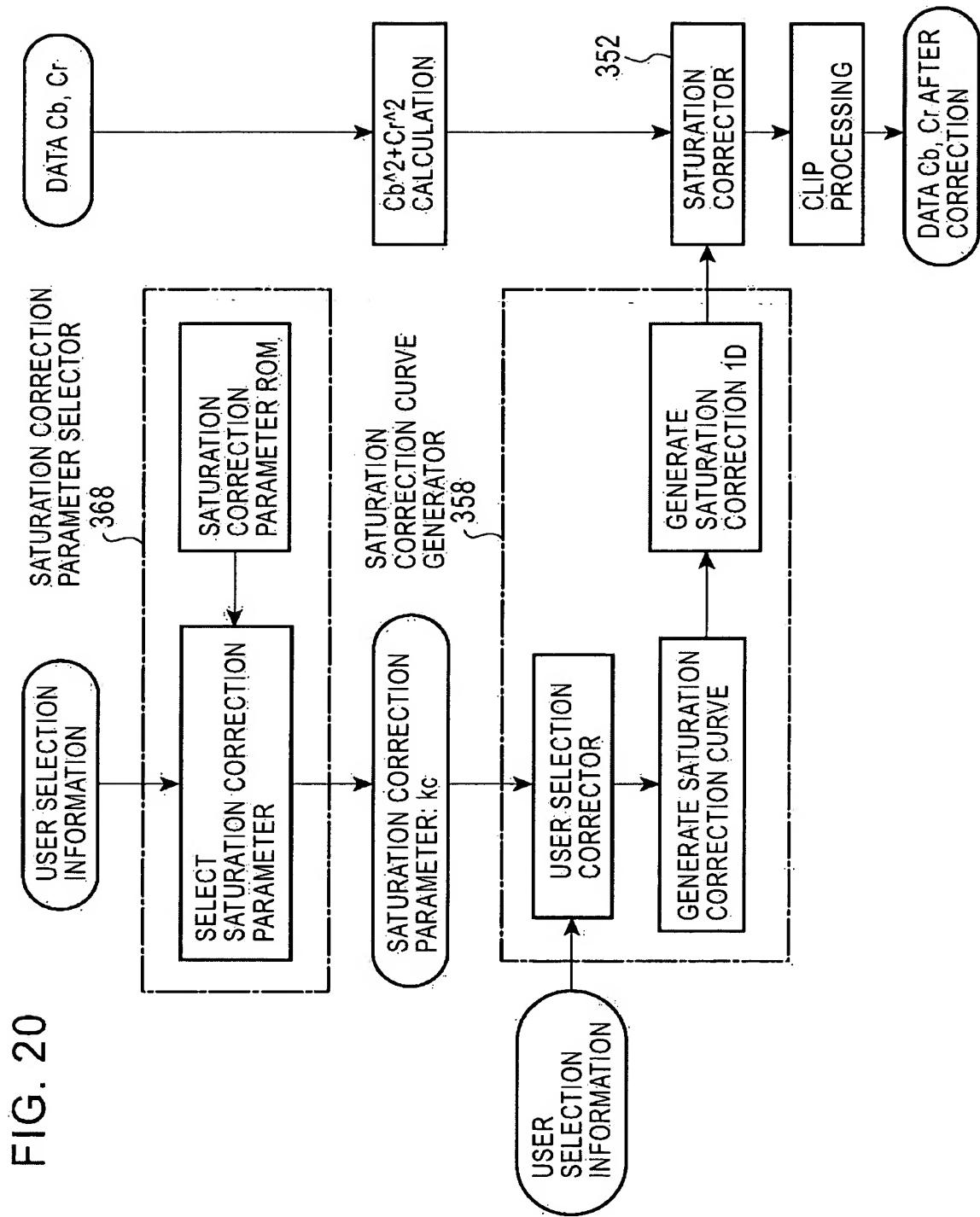


FIG. 19





S03P1083

20/25

FIG. 21

$$\begin{bmatrix} X_{\text{raw}} \\ Y_{\text{raw}} \\ Z_{\text{raw}} \end{bmatrix} = M_1 \cdot \begin{bmatrix} R' 2 \\ G' 2 \\ B' 2 \end{bmatrix} \quad (\text{EQUATION 1})$$

$$M_1 = \begin{bmatrix} 0.4124 & 0.3576 & 0.1805 \\ 0.2126 & 0.7152 & 0.0722 \\ 0.0193 & 0.1192 & 0.9505 \end{bmatrix}$$

$$\begin{bmatrix} X_{\text{raw\_n}} \\ Y_{\text{raw\_n}} \\ Z_{\text{raw\_n}} \end{bmatrix} = M_2 \cdot \begin{bmatrix} X_{\text{raw}} \\ Y_{\text{raw}} \\ Z_{\text{raw}} \end{bmatrix} \quad (\text{EQUATION 2})$$

WHERE

$$M_2 = \begin{bmatrix} 1/(Y_{\text{raw\_ave}} \times 5) & 0 & 0 \\ 0 & 1/(Y_{\text{raw\_ave}} \times 5) & 0 \\ 0 & 0 & 1/(Y_{\text{raw\_ave}} \times 5) \end{bmatrix}$$

$$\begin{bmatrix} R' 3 \\ G' 3 \\ B' 3 \end{bmatrix} = M_1^{-1} \cdot \begin{bmatrix} X_{\text{raw\_n}} \\ Y_{\text{raw\_n}} \\ Z_{\text{raw\_n}} \end{bmatrix} \quad (\text{EQUATION 3})$$

$$\begin{cases} R_{\text{scRGB}} = \text{round}[(R' 3 \times 8192.0) + 4096.0] \\ G_{\text{scRGB}} = \text{round}[(G' 3 \times 8192.0) + 4096.0] \\ B_{\text{scRGB}} = \text{round}[(B' 3 \times 8192.0) + 4096.0] \end{cases} \quad (\text{EQUATION 4})$$

$$\begin{cases} R' 3 = (R_{\text{scRGB}} + 8192.0) - 0.5 \\ G' 3 = (G_{\text{scRGB}} + 8192.0) - 0.5 \\ B' 3 = (B_{\text{scRGB}} + 8192.0) - 0.5 \end{cases} \quad (\text{EQUATION 5})$$

S03P1083

21/25

## FIG. 22

$$R' \geq 0, G' \geq 0, B' \geq 0$$

$$\begin{cases} R'_{scRGB} = 1.055 \times R' (1.0/2.4) - 0.055 \\ G'_{scRGB} = 1.055 \times G' (1.0/2.4) - 0.055 \\ B'_{scRGB} = 1.055 \times B' (1.0/2.4) - 0.055 \end{cases} \quad (\text{EQUATION 6-a})$$

$$0.0031308 > R' \geq 0, G' \geq 0, B' \geq 0 > -0.0031308$$

$$\begin{cases} R'_{scRGB} = 12.92 \times R' \\ G'_{scRGB} = 12.92 \times G' \\ B'_{scRGB} = 12.92 \times B' \end{cases} \quad (\text{EQUATION 6-b})$$

$$R' \leq 0, G' \leq 0, B' \leq 0$$

$$\begin{cases} R'_{scRGB} = -1.055 \times (-R') (1.0/2.4) + 0.055 \\ G'_{scRGB} = -1.055 \times (-G') (1.0/2.4) + 0.055 \\ B'_{scRGB} = -1.055 \times (-B') (1.0/2.4) + 0.055 \end{cases} \quad (\text{EQUATION 6-c})$$

$$\begin{bmatrix} Y'_{scYCC} \\ C_b'_{scYCC} \\ C_r'_{scYCC} \end{bmatrix} = M3 \cdot \begin{bmatrix} R'_{scRGB} \\ G'_{scRGB} \\ B'_{scRGB} \end{bmatrix} \quad (\text{EQUATION 7})$$

WHERE

$$M3 = \begin{bmatrix} 0.2990 & 0.5870 & 0.1140 \\ -0.1687 & -0.3313 & 0.5000 \\ 0.5000 & -0.4187 & -0.0813 \end{bmatrix}$$

$$\begin{cases} Y_{scYCC} = \text{round}[(Y'_{scYCC} \times 1280) + 1024] \\ C_b'_{scYCC} = \text{round}[(C_b'_{scYCC} \times 2048) + 1024] \\ C_r'_{scYCC} = \text{round}[(C_r'_{scYCC} \times 2048) + 1024] \end{cases} \quad (\text{EQUATION 8})$$

$$T w' = T w + \Delta T \quad (\text{EQUATION 9})$$

S03P1083

22/25

## FIG. 23

$$\begin{cases} x_d' = -4.6070 \times 10^9 / T w'^3 + 2.9678 \times 10^6 / T w'^2 \\ \quad + 0.09911 \times 10^3 / T w' + 0.244063 \\ y_d' = -3.000 \times x_d'^2 + 2.870 \times x_d' - 0.275 \end{cases} \quad (\text{EQUATION 10})$$

$$\begin{cases} Xw' = x_d' / y_d' \\ Yw' = 1 \\ Zw' = (1 - x_d' - y_d') / y_d' \end{cases} \quad (\text{EQUATION 11})$$

$$\begin{bmatrix} R'w \\ G'w \\ B'w \end{bmatrix} = M1^{-1} \cdot \begin{bmatrix} Xw' \\ Yw' \\ Zw' \end{bmatrix} \quad (\text{EQUATION 12})$$

$$\begin{cases} k_r = R'w / R_w \\ k_g = G'w / G_w \\ k_b = B'w / B_w \end{cases} \quad (\text{EQUATION 13})$$

$$\begin{cases} R_{scRGB\_T} = \text{round}[k_r \times R_{scRGB}] \\ G_{scRGB\_T} = \text{round}[k_g \times G_{scRGB}] \\ B_{scRGB\_T} = \text{round}[k_b \times B_{scRGB}] \end{cases} \quad (\text{EQUATION 14})$$

$$\begin{cases} Y' scYCC = (Y' scYCC - 1024) / 1280 \\ C b' scYCC = (C b' scYCC - 2048) / 1280 \\ C r' scYCC = (C r' scYCC - 2048) / 1280 \end{cases} \quad (\text{EQUATION 15})$$

$$\begin{bmatrix} R' scRGB \\ G' scRGB \\ B' scRGB \end{bmatrix} = M3^{-1} \cdot \begin{bmatrix} Y' scYCC \\ C b' scYCC \\ C r' scYCC \end{bmatrix} \quad (\text{EQUATION 16})$$

S03P1083

23/25

FIG. 24

 $R' scRGB, G' scRGB, B' scRGB \geq 0.04045$ 

$$\left\{ \begin{array}{l} R' 3 = \left[ \frac{R' scRGB + 0.055}{1.055} \right]^{2.4} \\ G' 3 = \left[ \frac{G' scRGB + 0.055}{1.055} \right]^{2.4} \\ B' 3 = \left[ \frac{B' scRGB + 0.055}{1.055} \right]^{2.4} \end{array} \right. \quad (\text{EQUATION 17-a})$$

 $0.04045 > R' 3, G' 3, B' 3 > -0.04045$ 

$$\left\{ \begin{array}{l} R' 3 = R' scRGB / 12.92 \\ G' 3 = G' scRGB / 12.92 \\ B' 3 = B' scRGB / 12.92 \end{array} \right. \quad (\text{EQUATION 17-b})$$

 $R' 3, G' 3, B' 3 \leq -0.04045$ 

$$\left\{ \begin{array}{l} R' 3 = - \left[ \frac{(-R' scRGB) + 0.055}{1.055} \right]^{2.4} \\ G' 3 = - \left[ \frac{(-G' scRGB) + 0.055}{1.055} \right]^{2.4} \\ B' 3 = - \left[ \frac{(-B' scRGB) + 0.055}{1.055} \right]^{2.4} \end{array} \right. \quad (\text{EQUATION 17-c})$$

S03P1083

24/25

## FIG. 25

 $R' \text{ scRGB}, G' \text{ scRGB}, B' \text{ scRGB} < 0$ 

$$\begin{cases} R = 0 \\ G = 0 \\ B = 0 \end{cases} \quad (\text{EQUATION 18-a})$$

 $0 \leq R' \text{ scRGB}, G' \text{ scRGB}, B' \text{ scRGB} \leq 1.0$ 

$$\begin{cases} R = \text{round}(R' \text{ scRGB} \times 255) \\ G = \text{round}(G' \text{ scRGB} \times 255) \\ B = \text{round}(B' \text{ scRGB} \times 255) \end{cases} \quad (\text{EQUATION 18-b})$$

 $1.0 < R' \text{ scRGB}, G' \text{ scRGB}, B' \text{ scRGB}$ 

$$\begin{cases} R = 255 \\ G = 255 \\ B = 255 \end{cases} \quad (\text{EQUATION 18-c})$$

$$S_{\text{fwd}}(x) = \frac{1}{1 + e^{-\pi r(x-x_0)}} \quad (\text{EQUATION 19-a})$$

$$Y_{\text{out}} = \frac{S_{\text{fwd}}(Y_{\text{in}}) - S_{\text{fwd}}(0)}{S_{\text{fwd}}(1) - S_{\text{fwd}}(0)} \quad (\text{EQUATION 19-b})$$

$$S_{\text{inv}}(x) = -\frac{1}{\pi r} \ln \left( \frac{1}{x} - 1 \right) + x_0 \quad (\text{EQUATION 20-a})$$

$$Y_{\text{out}} = \frac{S_{\text{inv}}(Y_{\text{in}}) - S_{\text{inv}}(0)}{S_{\text{inv}}(1) - S_{\text{inv}}(0)} \quad (\text{EQUATION 20-b})$$

$$C_{\text{out}} = k \cdot c \times C_{\text{in}} \quad (\text{EQUATION 21})$$

$$Y_{\text{out\_TV}} = Y_{\text{out}} \times B_{\text{KTV}} \quad (\text{EQUATION 22})$$

## FIG. 26

$$Y_{max\_TV} = Y_{max} \times W_{TV} \quad (\text{EQUATION 23})$$

$$k_c \cdot TV = k_c \times C_{TV} \quad (\text{EQUATION 24})$$

$$Y_{max\_Pic} = Y_{max} \times W_{pic} \quad (\text{EQUATION 25})$$

$$k_c \cdot Pic = k_c \times C_{pic} \quad (\text{EQUATION 26})$$

$$Y_{min\_User} = Y_{min} \times B_K_{user} \quad (\text{EQUATION 27})$$

$$Y_{max\_User} = Y_{max} \times W_{user} \quad (\text{EQUATION 28})$$

$$k_c \cdot User = k_c \times C_{user} \quad (\text{EQUATION 29})$$

$$G_{user} = 2 - \frac{B_K_{user} + W_{user}}{2} \quad (\text{EQUATION 30})$$

$$\begin{bmatrix} R \\ G \\ B \end{bmatrix} = \begin{bmatrix} 255 & 0 & 0 \\ 0 & 255 & 0 \\ 0 & 0 & 255 \end{bmatrix} \cdot M_3^{-1} \cdot \begin{bmatrix} Y' \\ C_b' \\ C_r' \end{bmatrix} \quad (\text{EQUATION 31})$$